

CLAIMS

We claim:

1. A composition, comprising a halogenated hydrocarbon solvent, and a co-solvent which is miscible with the halogenated hydrocarbon solvent, and a conductivity enhancing substance which is soluble in at least one of the halogenated hydrocarbon solvent and the co-solvent.
2. The composition of claim 1 wherein the conductivity enhancing substance is soluble in the co-solvent.
3. The composition of claim 2 wherein the conductivity enhancing substance is substantially insoluble in the halogenated hydrocarbon solvent.
4. The composition of claim 1 wherein the composition has an electrical conductivity at room temperature that is greater than 10 micro-Siemens/cm.
5. The composition of claim 1 wherein the halogenated hydrocarbon solvent and the co-solvent and the conductivity enhancing substance cooperate to produce a desired electrical conductivity.
6. The composition of claim 1 wherein the halogenated hydrocarbon solvent is chloroform.
7. The composition of claim 1 wherein the co-solvent has a dielectric constant greater than 20.

8. The composition of claim 1 wherein the co-solvent has a dielectric constant greater than 10.

9. The composition of claim 1 wherein the co-solvent is an alcohol.

10. The composition of claim 9 wherein the alcohol is methanol or ethanol.

11. The composition of claim 1 wherein the conductivity enhancing substance has at least one ionic bond.

12. The composition of claim 1 wherein the conductivity enhancing substance is a salt having an anion and a cation.

13. The composition of claim 12 wherein the anion is an organic radical.

14. The composition of claim 12 wherein the anion is a lipophilic radical.

15. The composition of claim 12 wherein the anion is selected from the group consisting of lactate, acetate, propionate, formate, salicylate, stearate, malate, laurate, oxalate, oleate, citrate, benzoate, succinate, myristate and tartarate.

16. The composition of claim 12 wherein the cation is a metal.

17. The composition of claim 12 wherein the cation is selected from the group consisting of sodium, potassium, calcium and magnesium.

18. The composition of claim 12 wherein the cation is an organic radical.
19. The composition of claim 12 wherein the cation is an ammonium radical.
20. The composition of claim 12 wherein the salt is selected from the group consisting of sodium L-lactate, potassium lactate, sodium stearate, sodium tetradecyl sulfate and sodium lauryl sulfate.
21. The composition of claim 12 wherein the salt is ammonium lactate.
22. The composition of claim 12 wherein the salt is ammonium acetate.
23. The composition of claim 1 wherein the conductivity enhancing substance is an acid.
24. The composition of claim 23 wherein the conductivity enhancing substance is an organic acid.
25. The composition of claim 23 wherein the acid is a liquid at room temperature.
26. The composition of claim 23 wherein the acid is acetic acid.
27. The composition of claim 1 wherein the conductivity enhancing substance is a polymer.

28. The composition of claim 27 wherein the polymer comprises side groups which can dissociate when the polymer is dissolved in a liquid.

29. The composition of claim 27 wherein the polymer is a methacrylate or poly lactic co-glycolic acid.

30. The composition of claim 27 wherein the conductivity enhancing substance is a polymeric acid.

31. The composition of claim 30 wherein the conductivity enhancing substance is poly acrylic acid, poly methacrylic acid, or poly lactic co-glycolic acid.

32. The composition of claim 27 wherein the polymer is a metallic salt of a polymeric acid.

33. The composition of claim 32 wherein the polymer is selected from the group consisting of a sodium salt of polyacrylic acid, a sodium salt of poly methacrylic acid, and carboxymethylcellulose sodium.

34. The composition of claim 1 wherein the conductivity enhancing substance is a solid at room temperature.

35. The composition of claim 1 wherein the conductivity enhancing substance is a solid at all temperatures up to a maximum allowable temperature of an article being manufactured.

36. The composition of claim 1 wherein the conductivity enhancing substance is a liquid at room temperature.

37. The composition of claim 1 wherein the conductivity enhancing substance has a boiling point which is lower than a maximum allowable temperature of an article being manufactured.

38. The composition of claim 1 wherein the conductivity enhancing substance has a sublimation temperature that is lower than a maximum allowable temperature of an article being manufactured.

39. The composition of claim 1 wherein the conductivity enhancing substance is capable of substantially evaporating at a temperature lower than a maximum allowable temperature of an article being manufactured.

40. The composition of claim 1 wherein the conductivity enhancing substance is capable of decomposing at a temperature lower than a maximum allowable temperature of an article being manufactured.

41. The composition of claim 1 wherein the conductivity enhancing substance is suitable to be dissolved by a supercritical fluid or a pressurized liquid.

42. The composition of claim 1 wherein the conductivity enhancing substance is suitable to be dissolved by a substance selected from the group consisting of: supercritical carbon dioxide, supercritical carbon dioxide with at least one additive, liquid carbon dioxide, and liquid carbon dioxide with at least one additive.

43. The composition of claim 1 wherein the conductivity enhancing substance is suitable to be dissolved by water or by alcohol or another organic solvent.

44. The composition of claim 1 wherein the conductivity enhancing substance comprises only at most carbon, oxygen, hydrogen and nitrogen.

45. The composition of claim 1 wherein the conductivity enhancing substance comprises only at most carbon, oxygen, hydrogen and nitrogen and an element selected from the group consisting of sodium, potassium, calcium and magnesium.

46. The composition of claim 1 wherein the conductivity enhancing substance is benign to the human body.

47. The composition of claim 1 wherein the halogenated hydrocarbon comprises at least approximately 70% by weight of the composition.

48. The composition of claim 1 wherein the co-solvent comprises between approximately 2% by weight and approximately 30% by weight of the composition.

49. The composition of claim 1, further comprising at least one additional substance dissolved in the composition.

50. The composition of claim 49 wherein the additional substance is a polymer.

51. The composition of claim 49 wherein the additional substance is an Active Pharmaceutical Ingredient.

52. A printhead comprising a source of droplets of a liquid, and a charging means for imparting charge to at least some droplets, and means for electrostatically deflecting the charged droplets, wherein the liquid includes a halogenated hydrocarbon solvent, a co-solvent that is miscible with the halogenated

hydrocarbon solvent, and a conductivity enhancing substance that is soluble in at least one of the halogenated hydrocarbon solvent and the co-solvent.

53. The printhead of claim 52, further comprising a means for stimulating formation of the droplets.

54. The printhead of claim 52 wherein the source of droplets is a continuous jet.

55. The printhead of claim 52, comprising an electrical component in contact with the liquid upstream of the droplets.

56. The printhead of claim 52 wherein the charging means is such that it imparts to any individual droplet either essentially no charge or sufficient charge so that the droplet is deflected to a catcher.

57. The printhead of claim 52 wherein the charging means is such that it imparts to any individual droplet either essentially no charge, or sufficient charge so that the droplet is deflected to a catcher, or an intermediate amount of charge.

58. The printhead of claim 52, having dimensions and operating voltages and operating parameters suitable to cooperate with properties of the liquid to produce desired deflections of droplets.

59. A method of three dimensional printing an article, comprising dispensing through a printhead a liquid composition comprising a halogenated hydrocarbon solvent, a co-solvent that is miscible with the halogenated hydrocarbon solvent, and a conductivity enhancing substance that is soluble in at least one of the halogenated hydrocarbon solvent and the co-solvent.

60. The method of claim 59 wherein the printhead comprises means for imparting electric charge to droplets of the liquid.

61. The method of claim 59 wherein the printhead is a continuous jet with deflection printhead.

62. The method of claim 59 wherein the printhead produces droplets by means other than a continuous jet.

63. The method of claim 59, further comprising, after the dispensing, heating the article to a sufficient temperature for a sufficient time to promote evaporation of at least some of the liquid composition.

64. The method of claim 63 wherein the evaporation includes evaporation of the conductivity enhancing substance.

65. The method of claim 63 wherein the heating is performed after deposition of the liquid composition on an individual powder layer.

66. The method of claim 63 wherein the heating is performed after completion of three-dimensional printing.

67. The method of claim 59, further comprising, after the dispensing, heating the article to a sufficient temperature for a sufficient time to cause decomposition of at least some of the liquid composition.

68. The method of claim 67 wherein the decomposition includes decomposition of the conductivity enhancing substance.

69. The method of claim 59, further comprising exposing the article to a sub-ambient pressure for a time sufficient to promote evaporation of at least some of the liquid composition.

70. The method of claim 69 wherein the evaporation includes evaporation of the conductivity enhancing substance.

71. The method of claim 69, further comprising heating the article.

72. The method of claim 59, further comprising exposing the article to a flow of gas which is substantially free of the vapor of the liquid composition, for a time sufficient to promote evaporation of at least some of the liquid composition.

73. The method of claim 72 wherein the evaporation includes evaporation of the conductivity enhancing substance.

74. The method of claim 72, further comprising heating the article.

75. The method of claim 59, further comprising exposing the article to a supercritical fluid or a pressurized liquid of a substance that is gaseous at room temperature, under conditions suitable to remove at least one component of the liquid composition.

76. The method of claim 75 wherein the supercritical fluid or pressurized liquid is carbon dioxide.

77. The method of claim 75 wherein the supercritical fluid or pressurized liquid comprises carbon dioxide and an extraction co-solvent substance.

78. The method of claim 77 wherein the extraction co-solvent substance comprises methanol or acetone.

79. The method of claim 75 wherein the supercritical fluid or pressurized liquid comprises nitrous oxide or sulfur hexafluoride or a hydrocarbon or halogenated hydrocarbon having an atmospheric boiling point below room temperature.

80. The method of claim 59, further comprising exposing the article to water or an alcohol or another organic solvent.

81. An article manufactured by the method of claim 59.

82. The article of claim 81 wherein the article contains substantially no halogenated hydrocarbon solvent or co-solvent or conductivity enhancing substance.